

## **SURFACE EVOLUTION OF NICKEL AND TUNGSTEN UNDER $\text{He}^+$ AND $\text{H}^+$ ION IRRADIATION BY MEANS OF KELVIN PROBE**

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Nickel, capable of trapping more helium than hydrogen, is one of the potential materials to be used near the divertor or the limiter to trap the helium ash produced by D-T reactions. Tungsten, due to its excellent resistance to heavy heat load and various irradiations, has been selected as plasma facing material for divertor in ITER-FEAT design. It is thus necessary to study the effect of the irradiations on the surface properties of these materials, which may affect the particle balance within a fusion reactor.

Polycrystalline Ni and W samples with a purity of 99.95% were used in the research. The experiments were performed using  $\text{He}^+$  and  $\text{H}^+$  ion beams of 1 MeV,  $2 \times 10^{16}$  ions/m<sup>2</sup>/s under a pressure of  $1 \times 10^{-4}$  Pa, and a  $\text{He}^+$  beam of 500 eV,  $2 \times 10^{16}$  ions/m<sup>2</sup>/s under a working pressure of about  $1 \times 10^{-2}$  Pa. The samples were cleaned with acetone and ethanol prior to mounting into the vacuum chamber. The irradiations were done at room temperature. The work function (WF), extremely sensitive to various surface changes, was recorded using a Kelvin probe via measuring the contact potential difference (CPD) between the probe and the sample. Various measures have been taken to eliminate detrimental charging effect due to charges generated inside the vacuum chambers, which ensured the reliable acquisition of the data in the experiments [1].

The results indicated that the irradiation of 500 eV  $\text{He}^+$  resulted in a WF decrease, then an increase till saturation, while 1 MeV ions only induced a WF decrease, then saturation. A surface model of loosely bound adsorbed layer plus native oxide layer on metals is presented to explain the observed phenomena. The nuclear stopping is responsible for the results in the case of 500 eV  $\text{He}^+$  irradiation that is powerful enough to sputter away the whole overlayer from the bulk surface. In MeV case, the electronic stopping plays a decisive role, which allows merely the topmost adsorbed layer to be removed by  $\text{He}^+$  and  $\text{H}^+$  ions of 1 MeV. Due to desorption of the topmost adsorbed layer, the WF decreases as a result of decrease of the surface dipoles towards to bulk. If the oxide layer is removed due to sputtering, the WF will increase simply due to the WF difference between the metal and its oxide, as indicated by Pope et al.[2].

[1] G. -N. Luo, K. Yamaguchi, T. Terai and M. Yamawaki, Rev. Sci. Instrum. 72(5) (2001) 2350.

[2] T. D. Pope, S. J. Bushby, K. Griffiths and P. R. Norton, Surf. Sci. 258 (1991) 101.